Space Weather Technical Forecast

Issued on Monday, 28 August 2023 at 13:11 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of isolated M-flares (R1-R2 Blackouts). Glancing CME arrival possible Day 3 (30 Aug) with slight chance of G1/Minor Storms.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low over the past 24 hours, with only one C-flare observed at 28/0402UTC. There are six sunspot regions on the visible disc, three of which are small and simple, however there are three sunspot groups of interest at this time. AR3415 in the southeast remains the most complex, with a persistent delta spot configuration, but has been largely inactive. The larger AR3413 near centre disc has is in a beta configuration, but retains a north-south magnetic alignment which could have some instability. A new (and currently unnumbered) region rotating over the east limb was responsible for a long period M-flare seen on 26th Aug, so this region is one to watch in the coming days.
A small prominence eruption was observed in the southwest of the disc at around 0500Z this morning, and will be assessed once more imagery comes in, but given its location it is not deemed to be Earth directed.
No other Earth directed CMEs have been seen in available imagery over the last 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by ACE at L1, were at mostly background levels. Wind speeds slowly eased from near 400 km/s to around 310 km/s. Density was mostly below average. The interplanetary magnetic field, Bt, was weak throughout, below 7nT. The north-south component, Bz, has been mainly negative (southward directed), varying weakly between +4/-6 nT. Phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet (Kp 1-2).

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux remained at background levels. GOES16 high energy (greater than 2MeV) electron flux was mostly at background levels. The associated 24-hour fluence was well below Active on a fairly steady trend, with 3.87e6 integrated pfu observed at 28/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar Activity is expected to be generally Low, but with a chance of isolated M-class flares.

Solar Wind / Geomagnetic Activity: A CME may give a glancing impact at Earth sometime on Day 3 (30 Aug), though this is low confidence. There are no other Earth-directed CMEs currently forecast. Wind speeds are currently at background levels and are expected to remain so until the potential CME arrival mentioned above.
Geomagnetic activity is expected to remain mostly Quiet. If the CME glance occurs on Day 3 (30 Aug), activity may become Unsettled to Active with a slight chance of G1/Minor Storm intervals, with effects easing into Day 4 (31 Aug).

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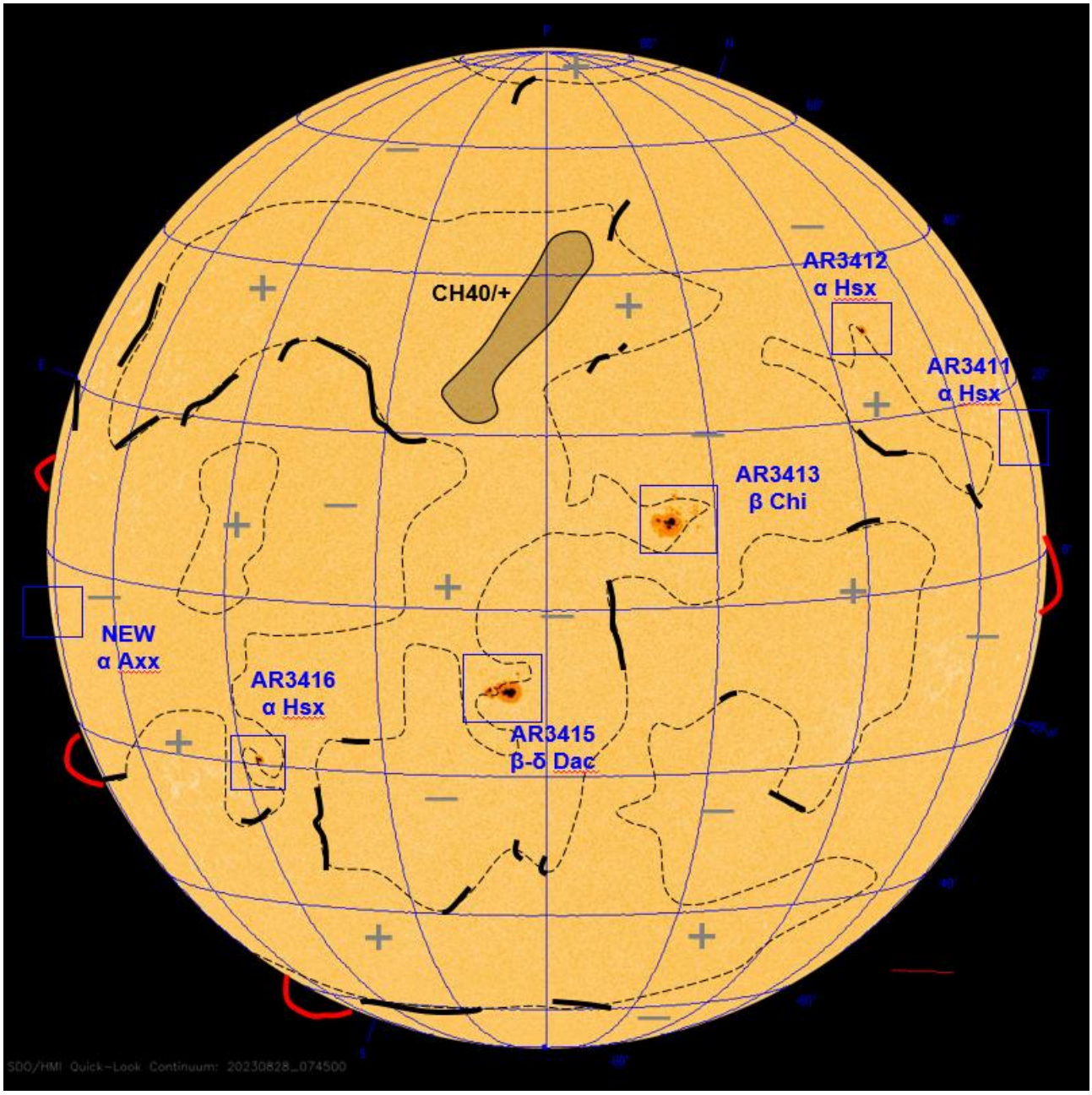
Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux is expected to remain at background levels, with just a slight chance of enhancement should any larger flares occur from AR3413, AR3415 or the new region rotating around the eastern limb. High energy (greater than 2 MeV) electron flux is expected to persist at mainly background levels, perhaps reaching moderate at the diurnal maxima. The associated 24 hour fluence is expected to remain below the Active level (1e8 integrated pfu).

Figure 1. Solar Analysis Valid 28/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The C2.2 flare and associated dimming from AR3413 at 25/1006 UTC likely produced a CME, with a very faint eruption subsequently detected in SOHO imagery. Assessment of this suggests a glancing CME impact is possible at Earth sometime on Day 3 (30 Aug) though this is low confidence. There are no other Earth-directed CMEs currently forecast.

Wind speeds are currently at background levels, and are expected to remain so until the potential CME arrival mentioned above.

Geomagnetic activity is expected to remain generally Quiet. If the CME glance occurs on Day 3 (30 Aug), activity may become Unsettled to Active with a slight chance of G1/Minor Storm intervals, with effects easing into Day 4 (31 Aug).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	1	15	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
26/1733	Partial	C2.2 flare	NW-centre disc	529 km/s	30/1200 UTC +/- 10 hours	Low confidence. Directed SE, despite NW location.

Figure 2a: ENLIL showing glancing blow from CME arrival on 30 Aug

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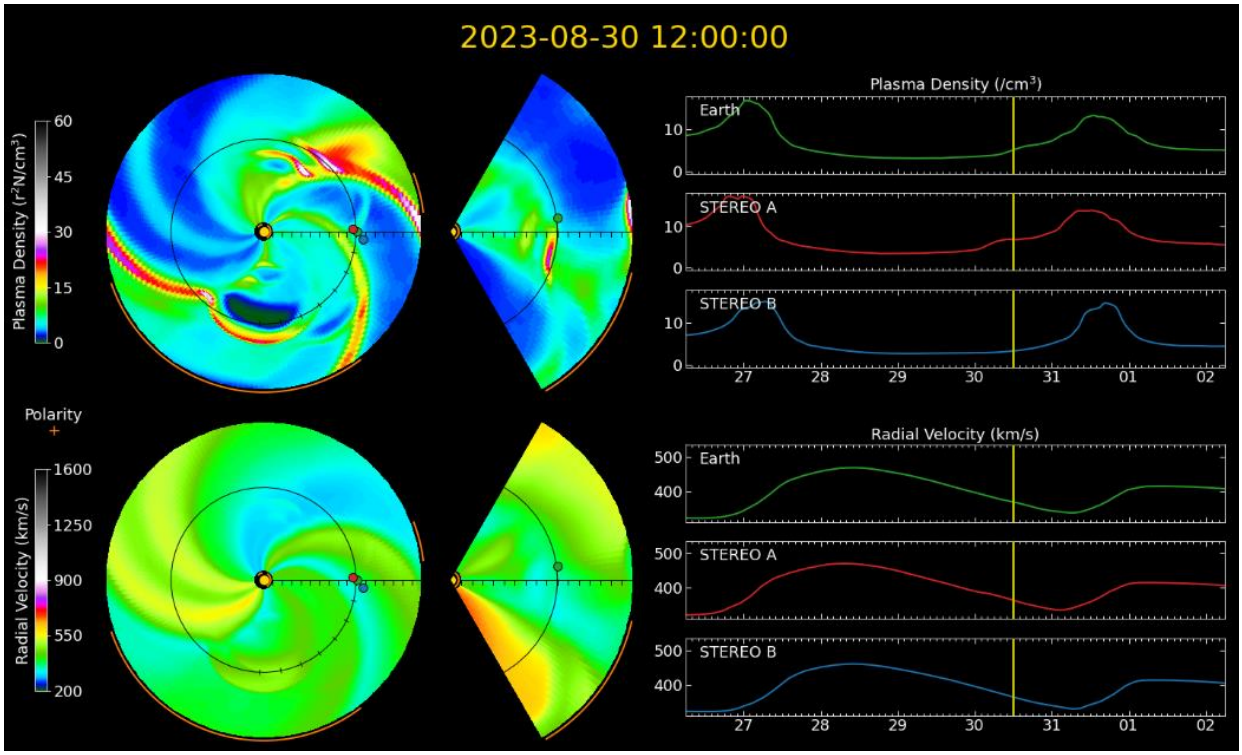
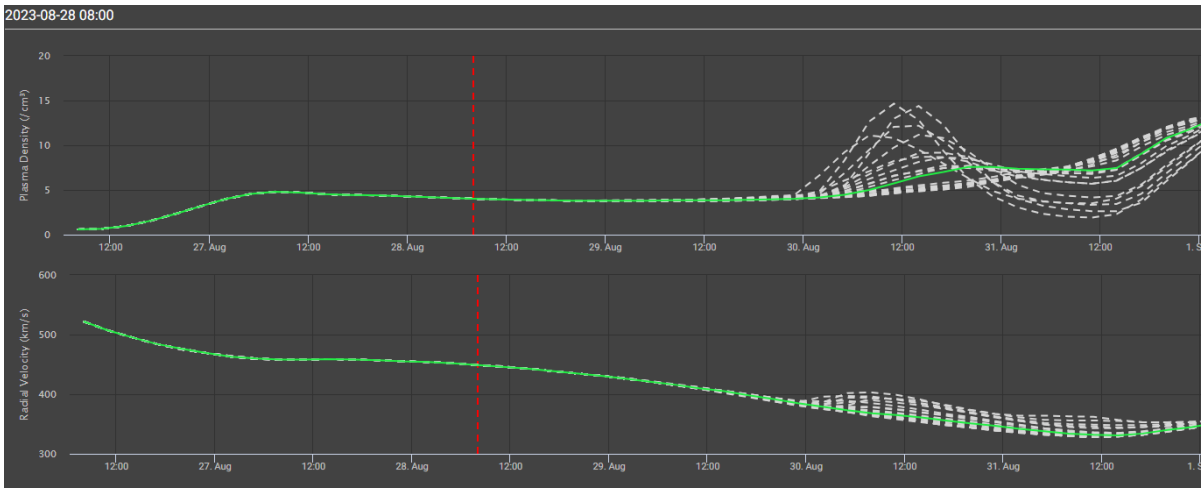


Figure 2b: ENLIL Ensemble to show the cluster of members for the glancing CME arrival on 30 Aug



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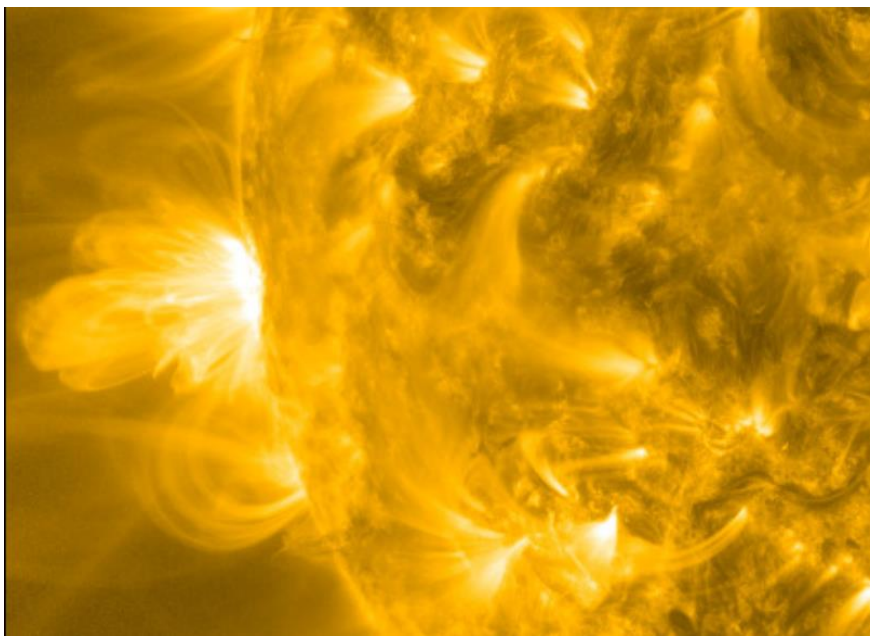
Radio Blackouts - X-Ray Flares:
Solar activity has been Low. Generally Low activity is expected during the forecast period, but there is a chance of further isolated M-flares, either from AR3413/AR3415 or perhaps more likely from the new region currently rotating onto the disc in the east, with a very slight chance of an isolated X-flare.

There are six sunspot regions on the visible disc. Three of these are small and simple with no change, however there are three sunspot groups of interest at this time. AR3415 (Dac/Beta-Delta) in the southeast remains the most complex, with a persistent delta spot configuration, but has remained largely inactive. The larger AR3413 (Chi/Beta) near centre disc is in a beta configuration fade, but retains a north-south magnetic alignment which could have some instability. The new region in the far east gave a long period M-flare on 26 Aug from over the eastern limb, so this region is one to watch. This region could increase activity once it rotates further around from the eastern limb, with magnetic looping visible in SDO AIA 171 imagery, so further complexity could possibly show itself as it becomes more visible. Therefore a slight increase in flare probability has been highlighted for now from Day 2 (29 Aug) onwards.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	No	25	35	35	35
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: SDO AIA 171 imagery showing magnetic looping associated with new sunspot region.



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Solar Radiation Storms - (High Energy Protons):
High energy (greater than 10MeV) proton flux observed by GOES16 is expected to remain at background levels with just a slight chance of enhancement. The main risk of any increased proton flux would be from the occurrence of any larger flares from AR3415 or AR3413, with these near centre disc and starting to transit through the western hemisphere.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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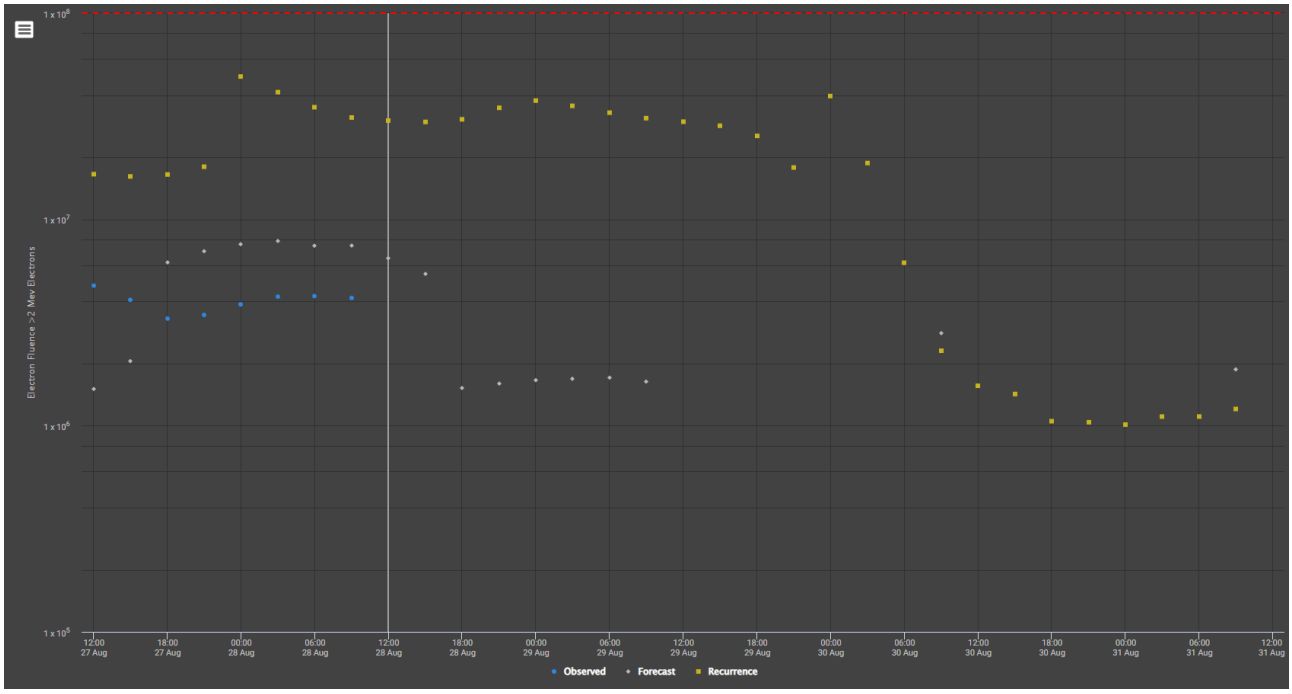
High Energy Electrons Event (≥ 2MeV):

High energy (greater than 2 MeV) electron flux observed by GOES16 persisted at mainly background levels and are expected to remain so for the rest of the period. A possible CME glancing blow on Day 3 (30 Aug) could also keep flux levels suppressed.

The associated 24 hour fluence is expected to remain below the Active (1e8 integrated pfu) level, with any rise in fluence likely to be modest. This is supported by REFM, which currently seems to be a reasonable guide.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	5	5	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: REFM – Electron fluence observations and reoccurance.



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